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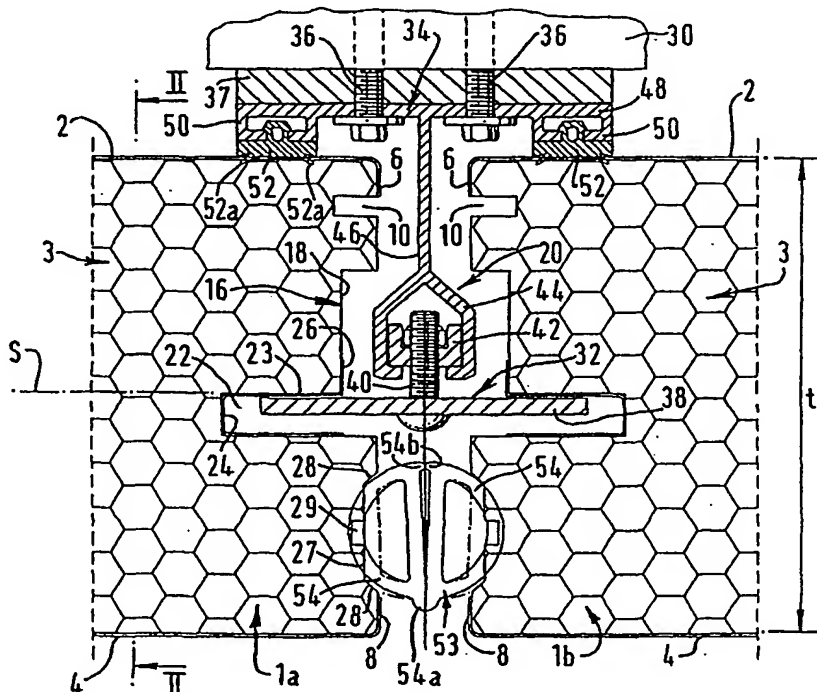
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(54) Title: A CLADDING SYSTEM

(57) Abstract

A cladding system including at least two panels (1a, 1b), each panel being made from a body (3) of material such as extruded expanded polystyrene. The body (3) may be a core of a panel having external sheet metal facings (2, 4). The body of each panel has a fixing surface (23) defined by a recess (22) formed in an edge of the material for co-operation with fixing means (20) whereby the panels can be fixed to a supporting structure (30).



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## A CLADDING SYSTEM

The invention relates to a cladding system which provides a facade for buildings. For many years Coseley Panel Products Limited have produced a system of interchangeable facade components such as panels for building. Each panel  
5 basically comprises an extruded core faced with metal such as steel or aluminium and having its perimeter formed by an aluminium edge profile. The panels are interconnected to form the facade by means of clamping arrangements which co-operate with the edge profiles to produce a very pleasing facade of high quality. Such claddings have been used on buildings such as corporate headquarters, banks  
10 and office premises where aesthetics and optimum quality are essential criteria. Certain buildings requiring cladding e.g. industrial premises, need the ease of assembly and insulation that the existing cladding panels made by Coseley Panel Products Limited will provide but at lower cost. In such circumstances, low cost yet high quality panels and construction are desirable and the present invention is  
15 concerned with a cladding panel system capable of meeting such a requirement.

According to one aspect of the invention, there is provided a cladding system including at least two panels, each panel being made from a main or core material and having a fixing surface formed in an edge of the material for co-operation with fixing means whereby the panels can be fixed to a supporting structure.

20 According to another aspect of the invention, there is provided a cladding system comprising at least two panels formed from plastics material each panel having a fixing surface formed in an edge of the material for co-operation with fixing means whereby the panels can be fixed to a supporting structure.

By having the fixing surface formed in an edge of the material itself for  
25 co-operation with the fixing means, it is not necessary to provide the aluminium edge profile thereby minimising cost and, at the same time, minimising weight.

In either aspect:

The fixing surface of each panel may be covered by a layer of load bearing material such as a layer of sheet metal which co-operates with the fixing means.

In the preferred embodiment, the fixing surface is a surface of a recess which extend substantially parallel with a face of the panel in which it is formed. The recess may  
5 extend for the full length of the edge. The recess may comprise a rectangular section for receiving part of the fixing means.

The fixing means may comprise clamp means arranged to apply a clamping force to the fixing surface of one or both of the panels to secure that panel or both panels to the supporting structure.

10 In the preferred embodiment, the clamp means comprises a first part which applies the clamping force to the or each fixing surface and a second part which connects the first part to the supporting structure.

In such a case, the second part of the clamp means may extend from a position adjacent an external surface of one of the panels to a position towards the fixing  
15 surface of the said panel.

Where the clamp means is arranged to apply a clamping force to the fixing surfaces of both panels for the purpose of fixing the panels to the supporting structure, the second part of the clamp means may extend between the two said edges of the panels. The second part of the aforesaid clamp means may include seal means  
20 which is preferably arranged to make sealing contact with a surface of one or both panels. Where the seal means of the second part of the clamp means is arranged to make sealing contact with surfaces of both said panels, the second part of the clamp means may bridge a space between the edges of both said panels so as to inhibit ingress or escape of moisture into or from the space.

25 A seal may be provided for positioning between the said edges of the panels in order to inhibit ingress or escape of moisture into or from a space between the edges of

both panels. The seal may comprise two parts which may be movable, e.g. hingeable relative to each other. The two parts may be hollow to permit the seal to compress. The seal may be substantially circular in cross-sectional outline, the said two parts preferably being of semi-circular outline form.

- 5 Preferably, the seal means of the second said clamp part and the seal which is to be positioned between the edges lie, in use, on opposite sides of the fixing surface.

- The fixing means may be arranged to fix one of the panels to a corner member where a corner is to be formed by the cladding, a said fixing surface being formed in the edge of each panel at the corner. Where a corner member is used we prefer the
- 10 fixing means to be arranged to connect the two panels together so that they lie transverse to each other, the fixing means preferably comprising first parts which apply a clamping force to the respective fixing surfaces of the two panels and to a common corner member between the edges of the panels formed with the fixing surfaces, and interconnected second parts which connect the first parts to
- 15 supporting structure.

The corner member is preferably constructed from the same material as the panels.

The corner member mentioned above may have edges for the fixing surfaces similar to the fixing surfaces of the panels for co-operation with the first part of the clamping means.

- 20 A verge may be provided to cover an upper edge of a cladding formed by the system.

A cill may be provided beneath the lower edge of a cladding formed by the system and by which any water draining through the system is guided away from the lower edge.

The verge and cill may be formed from a common section of material to minimise costs.

The preferred material for the panels is extruded expanded polystyrene. To reinforce the outer surfaces of the polystyrene, they may be covered with a layer of material such as sheet metal.

Each panel may, in use, have a horizontal edge which can be arranged adjacent a horizontal edge of a further panel arranged above or below the first said panel. The horizontal edges of the two said panels may include seal means for sealing against a horizontal edge of the or each further horizontal panel. In such a case the horizontal edge of the or each further panel may include seal means for making sealing contact with the seal means of one or both of the said two panels.

A load bearing member may be provided for the panels. The load bearing member is preferably attachable to the supporting structure. Lower horizontal edges of the panels may rest on the load bearing member for support.

- 15 In one embodiment, a said panel is constructed from a first body of material of one density and second body of material of a higher density through which second material load from the fixing means is transmitted. For example, the first and second bodies of material may comprise the same types of plastics material but of different densities.
- 20 Alternatively, a said panel may be constructed from a first body of material and a second material of higher density forming part of an edge of panel, through which second material load from the fixing means is transmitted. In such a case, the material of higher density may be in the form of a border around the first body or part of the first body of material.
- 25 A recess for receiving part of the fixing means may be defined between the first and second materials.

A cladding system in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a horizontal cross-section through part of the cladding system in accordance with the invention;

5      Figure 2 is a vertical cross-section through part of the system shown in Figure 1 on the line II - II in Figure 1;

Figure 3 is a cross-section through an edge seal shown in Figure 2;

Figure 4 is a horizontal cross-section through a verge for use in the system of Figure 1;

10      Figure 5 is a vertical cross section through a cill for the system shown in Figure 1;

Figure 6 shows the way in which panels may be joined together at corners of a building;

15      Figure 7 is a horizontal cross-section through two interconnected panels resting on a horizontal load bearing member;

Figure 8 is a cross-section through one of the panels in Figure 7 on the line VII - VII in Figure 7;

Figure 9 is a diagrammatic elevation of an assembled cladding system in accordance with the invention;

20      Figure 10 is an elevation of a clamping plate;

Figure 11 is a plan view of the load bearing member and

Figures 12 and 13 show alternative panel constructions.

Referring to Figures 1 and 2, two adjacent cladding panels 1a, 1b are formed from a body 3 of extruded expanded polystyrene available under the registered trade mark Styrofoam (Dow TM). The panels may have a thickness t of approximately 120 mm and have inner and outer facings 2, 4 respectively formed of material such as pre-coated steel, pre-coated aluminium, stainless steel, vitreous enamelled steel, copper or flat sheet decorative material. It will be noted that the facings 2, 4 extend for a short distance as indicated at 6, 8 respectively around end edges of the panels 1a, 1b. The body 3 forms a core for each panel 1a, 1b.

The panels are generally rectangular and the vertical end edges and horizontal upper and lower edges of each panel are profiled to define an arrangement of recesses which are now described in detail.

The recesses in the edges are continuous and extend around the full periphery of each sheet. A first recess 10 in the vertical edges of each panel remains unused but in the horizontal edges each recess 10 receives a fir-tree cross-section fixing part 12 of an edge seal 14 (see Figure 2). A second recess 16 comprises a first section 18 which defines clearance for part of a clamp 20 described in detail below and a second section 22 extending parallel with the facings 2, 4 and defining a fixing surface 23. The second section is covered with a sheet metal facing 24 part 26 of which extends into the first section 18. The metal may be steel, aluminium or other suitable metal. A third recess 27 is of flat-bottomed form with inclined walls 28. The recess 27 is itself recessed at 29.

When using the panels 1a, 1b to provide a cladding on a building (see Figure 9), the panels extend between vertical mullions 30 and, in accordance with normal building practice the mullions 30 will be spaced apart horizontally by a centre-to-centre distance of 7.2 metres. Normally, there will be intermediate vertical supports for conventional cladding but, with the present invention, the panels 1a, 1b are of sufficient thickness and strength not to require the intermediate vertical members



and, in that respect, the cladding system is highly advantageous from the point of assembly and cost.

In order to fix the cladding panels 1a, 1b between the two mullions 30, the panels 1a, 1b are fixed to each mullion by means of the clamp 20. The clamp 20 comprises a plurality of first parts 32 which apply clamping loads to the metal facing 24 of each panel (constituting the aforesaid fixing surface) and a vertically extending second part 34 which is fixed to the mullion 30 by means of vertically spaced sets of bolts 36. The bolts 36 may extend through a spacer 37. Each first part 32 of the clamp 20 comprises a steel plate 38 (see also Figure 11) formed with three vertically spaced apertures 39 through which upper, lower and intermediate bolts 40 (the upper bolt 40 being shown) pass. Each bolt 40 screws into a locking nut 42 which is held captive within a hollow end section 44 of the second clamp part 34. The second clamp part 34 is ideally formed as an aluminium extrusion.

A web 46 connects the end section 44 to a flange 48 of the second part 34, the flange 48 terminating at parallel undercut end channels 50, each of which carries an inner seal 52 having spaced apart sealing fingers 52a. The seal 52 is shown in a relaxed condition. In use, the second part 34 of clamp 20 is initially bolted to the mullion 30 and several first clamp parts 32 are screwed to the second part 34 at vertically spaced positions. The bolts 40 are then tightened by means of a tool (not shown) which is inserted from the outside between the spaced apart edges of the panels 1a, 1b.

By tightening the bolts 40, the plate 38 is urged against the facing 26 and the sealing fingers 52a of the seals 52 are drawn into sealing contact with the facings 2 of the panels 1a, 1b. Junctures (not shown) between the horizontal edge seals 14 at the upper and lower edges of the respective panels 1a, 1b are contained between the two seals 52.

Once the bolt 40 has been tightened sufficiently to clamp the panels 1a, 1b in place an outer edge seal 53 is inserted between the vertical edges of the panels 1a, 1b on the outside so that it slips into the recesses 27 as shown in Figures 1a and 2. A seal 53 is also slipped between the horizontal edges of upper and lower panels 1a and 1b as shown in Figure 2. The seal 53 comprises first and second semi-circular hollow sections 54 which are joined together at a protrusion 54a and which have free edges defined by protrusions 54b. The seal 53 is made from a suitable elastomeric-like material and the free edges 54b can hinge apart about the protrusion 54a. In Figure 1 the seal 53 is shown in full lines in a semi-relaxed condition. The actual condition of the seal when located between the panels 1a, 1b is substantially as shown in broken lines. The seal 53 is able to accommodate a certain amount of relative movement between the panels 1a, 1b without the sealing effect of the seal being lost. Similarly in Figures 2 and 4 to 8, the seal 53 is shown in a semi-relaxed condition.

The construction of the seal 14 can be seen in detail in Figure 3. The seal 14 is formed as an ethylene-propylene-diene (EPDM) extrusion. The seal is of two-part construction, a first part 14a being formed, for example of a foamed or cellular EPDM material to form a flexible sealing part and the second part indicated at 14b being made, for example from solid EPDM material. The two parts 14a, 14b are extruded simultaneously so as to form a unitary seal. The seal part 14b has the fixing part 12 formed integrally therewith.

The assembly process for the clamping panels is repeated over the length of the building.

As shown in Figure 4, the uppermost edge of the assembled panels is provided with a verge 55. The verge 55 is an extruded aluminium member having an upper section 56 bolted to a horizontal support 57 and a vertical flange 58 having an undercut end channel 50 carrying a seal 52. A hollow section 60 similar to the hollow section 44 is connected to the upper section 56 on the flange 58 by means of respective webs

- 62, 64. A seal 14 may be positioned as shown in sealing contact with the web 64. The clamping arrangement is similar to that shown in Figure 1 and like parts carry corresponding reference numerals. As will be seen in Figure 4, a clamping plate 38a clamps against the facing 24 and the web 62 and draws the seal 52 into sealing contact with the facing 2 of the panels 1a, 1b. The clamping plate 38a is similar to the clamping plate 38 but is narrower and the apertures 39 are offset from the centre of the plate. The upper section 56 of the verge 54 is integral with a part cylindrical section 65 defining a recess 65a which is similar to and which lies opposite the recess 27 of the panels 1a/1b for receiving the outer seal 53.
- 10 Figure 5 shows a cill 66 which is positioned at ground level and locates the lower edges of the lower most panels 1a, 1b. The cill 66 is of identical construction to the verge 54 except that a wall 61 of the hollow section 60 and webs 68, 69 which support the cylindrical section 64 are formed with drainage apertures 70, 72 respectively. The remaining features of the cill will not be described in detail but parts corresponding to parts described in Figure 4 carry the same reference numerals. In Figures 1 to 5 the seals 53 inhibit ingress of water resulting, for example, from rain being driven against the exterior facings 4 of the panels. However, where any water leaks into the recess 16 past the seal 53 it runs to the bottom of the cladding and drains through the apertures 70. The seals 52 positively inhibit water leaking to the inside of the building. A metal facing 74 extends from the lower end of the second clamp part 34 to a position between the seal 52 and the inner facing 2.
- 15
- 20

Referring to Figure 6, two panels 1a, 1b can be interconnected at a corner of a building by using a corner member 76 made of Styrofoam and having a metal facing 4. The corner section 76 is formed with two cylindrical vertically extending recesses 78 similar to recess 28 and two recess 80 which are lined with sheet metal facings 82. An orthogonal clamp 84 is provided and comprises two first parts 32 similar to the parts 32 shown in Figure 1 and two orthogonal second parts 34 each of

25

which is similar to the second part 34 of the clamp shown in Figure 1. The clamp 84 has undercut end channels 86 each of which carries a seal 52. In use, the clamp 84 is bolted to a corner mullion 30a and the two panels 1a, 1b along with the corner section 76 are then clamped in position shown using the bolts 40. In that way, the seals 52 are brought into sealing contact with the panels 1a, 1b and seals 53 are finally inserted into the recesses 28, 78. In Figure 6, the seals 53 are shown in full lines in a semi-relaxed condition but, in practice, will look more like the broken line shape shown in Figure 1 when inserted between the panels 1a, 1b. It will be noted that faces 77 of the corner section 76 are of complementary shape to the respective adjacent faces 35 of the orthogonal parts 34. In the clamped condition, the faces 77 are urged firmly against the said adjacent faces of the orthogonal parts 34 to form a rigid construction.

Figure 7 shows the arrangement of Figure 1 where a load bearing member 90 is mounted on the clamp 20 for supporting the lower horizontal edges of the panels 1a, 1b. As shown in Figure 8, the load bearing member 9 is of angle construction having a continuous vertical flange 92 and a horizontal flange 94 which is cut away at 96 (as shown in Figures 7 and 10) to accommodate the end section 44 of the clamp 20. Upper and lower bolts 40 (one only of which is shown) pass through the vertical flange 92 of the load bearing member 90, through a spacer 95 and screw into locking nuts 42. In that way, the weight of the panels 1a, 1b is transferred to the vertical mullions 30 through the clamp 20 whereby lower panels 1a, 1b of the cladding do not have to support the weight of upper panels 1a, 1b. In Figure 8, the seals 14 are shown in relaxed conditions. In practice they will tend to look more like the seals 14 in Figure

It will be appreciated that the system comprises several parts of common shape particularly as apparent from Figures 3, 4 and 5 which minimise costs.

Figures 1 to 8 the panels 1a, 1b are formed from extruded expanded polystyrene material which is of constant density throughout. In order to withstand the clamping

forces imported by the clamp 20 the extruded expanded polystyrene needs to be of sufficient density to resist crushing whilst, at the same time, not being too heavy to make the panel difficult to handle. Whilst the right compromise is possible to achieve, Figures 12 and 13 illustrate options for panel construction which help to  
5 address that problem very effectively.

The material from which the body 3 of each panel is made may be of a density in a range  $10\text{kg/m}^3$  to  $60\text{kg/m}^3$

In Figure 12, the panel 1a is formed as a dual-density unit having an outside section 95 formed from extruded polystyrene of light density, for example  $28\text{kg/m}^3$  and an  
10 inside section 96 of greater density, for example  $50\text{kg/m}^3$ . Again, the materials may have a density range of  $10\text{kg/m}^3$  to  $60\text{kg/m}^3$

The sections 95 and 96 adjoin on a plane S which is also indicated in Figure 1. It will be appreciated that the dropping force applied by the clamp 20 will be applied to the higher density section 96. In that way both a light weight but relatively strong  
15 panel can be provided.

In Figure 13, the panel 1a is a triple-section unit having an outer section 95, an inner section 96 and a border 97 surrounding the inner section 96. Unlike Figure 12, the inner and outer sections 96 are formed from extruded polystyrene of light density whilst the border 97 has a greater density. Examples of density ranges are  
20 the same as those set out above. The border 97 is arranged on the plane S and withstands the clamping force applied by the clamp 20. Instead of using two sections 95, 96, the panel may comprise a single-section 95 which is recessed to receive the higher density section 97 in the position shown in Figure 13.

### Claims

1. A cladding system including at least two panels, each panel being made from a body of material having a fixing surface formed in an edge of the material for co-operation with fixing means whereby the panels can be fixed to a supporting  
5 structure.
2. A cladding system according to claim 1 in which the fixing surface of each panel is covered by a layer of load bearing material which co-operates with the fixing means.
3. A cladding system according to claim 2 in which the load bearing material is  
10 a layer of sheet material such as metal.
4. A cladding system according to claim 1, 2 or 3 in which the fixing surface is a surface of a recess extending substantially parallel with a face of its panel.
5. A cladding system according to any preceding claim in which the fixing means comprises clamp means arranged to apply a clamping force to the fixing  
15 surface of one of the panels to secure that panel to the supporting structure.
6. A cladding system according to claim 5 in which the clamp means comprises a first part which applies the clamping force to the or each fixing surface and a second part which connects the first part to the supporting structure.
7. A cladding system according to claim 6 in which the second part of the clamp  
20 means extends from a position adjacent an external face of one of the panels to a position towards the fixing surface of the said panel.

8. A cladding system according to claim 6 or 7 and where the clamp means is arranged to apply a clamping force to the fixing surfaces of both panels simultaneously for the purpose of fixing the panels to the supporting structure, in which the second part of the clamp means extends between the two said edges of the  
5 panels.

9. A cladding system according to claim 6, 7 or 8 in which the second part of the clamp means includes seal means arranged to make sealing contact with a surface of one or both panels.

10. A cladding system according to claim 9 and where the seal means of the  
10 second part of the clamp means is arranged to make sealing contact with surfaces of both said panels, in which the second part of the clamp means bridges a space between the edges of both said panels so as to inhibit ingress or escape of moisture into or from the space.

11. A cladding system according to any preceding claim in which a seal is  
15 provided for positioning between the said edges of the panels in order to inhibit ingress or escape of moisture into or from a space between the edges of both panels.

12. A cladding system according to claim 11 in which the seal comprises two interconnected parts.

13. A cladding system according to claim 12 in which the parts are hinged  
20 together for hinging movement relative to each other.

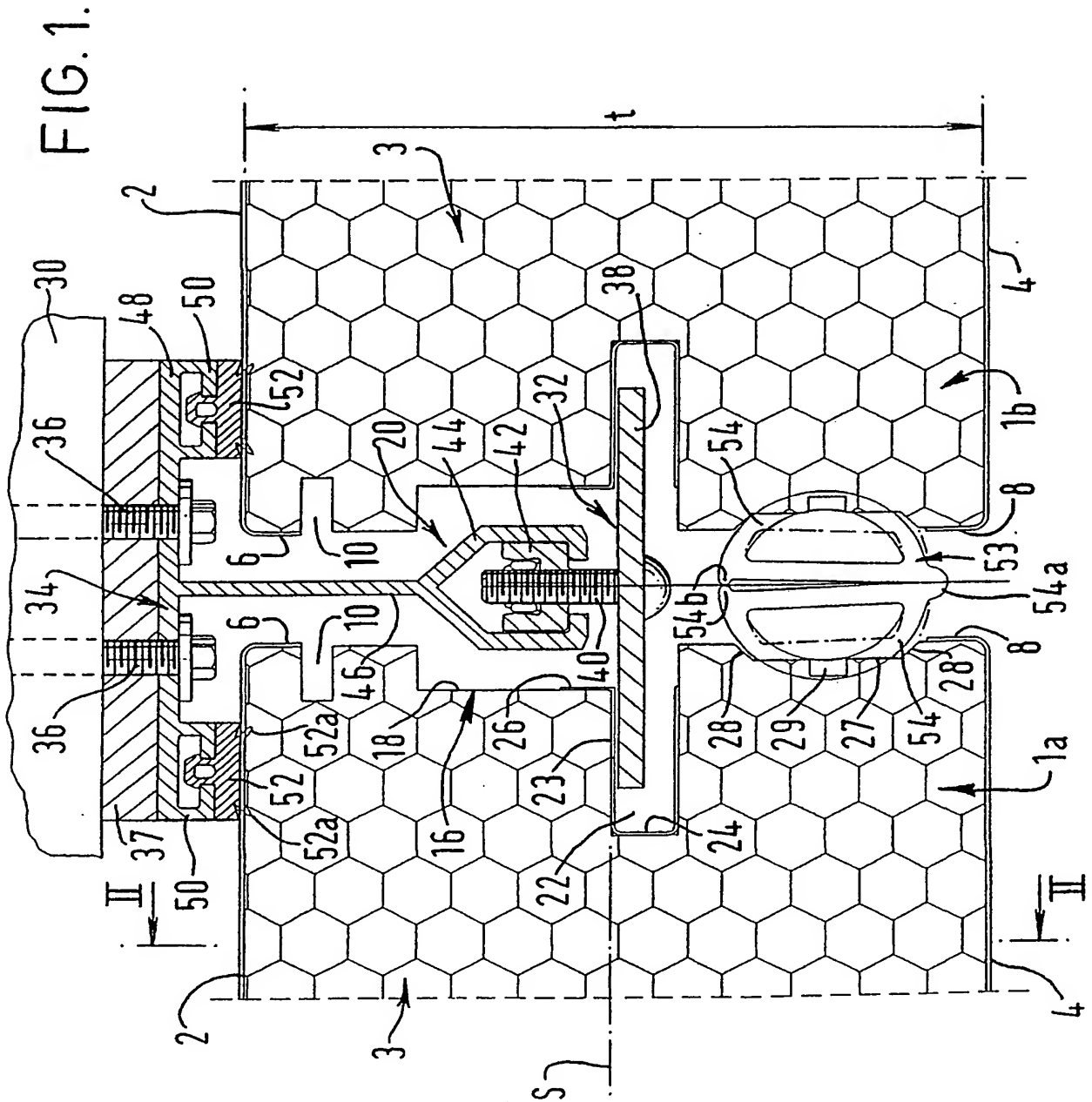
14. A cladding system according to claim 12 or 13 in which the two parts are hollow to permit the seal to compress.

15. A cladding system according to 12, 13 or 14 in which the said two parts are of substantially semicircular outline form.

16. A cladding system according to any of claims 11 to 15 when appendant to claim 10 in which the seal means of the second said clamp part and the seal which is to be positioned between the edges lie, in use, on opposite sides of the fixing surface.
- 5 17. A cladding system according to any preceding claim in which the fixing means is arranged to fix the panels to a corner member where a corner is formed by the cladding, a said fixing surface being formed in the edge of each panel at the corner.
18. A cladding system according to claim 17 in which the fixing means  
10 comprises first parts which apply a clamping force to the respective fixing surfaces of the two panels and to the common corner member between the edges of the panels formed with the fixing surfaces, and second parts which connect the first parts to supporting structure.
19. A cladding system according to claim 18 in which the second parts of the  
15 fixing means are interconnected.
20. A cladding system according to claim 19 in which the fixing means is substantially of cruciform shape.
21. A cladding system according to any of claims 17 to 20 in which the corner member is constructed from the same material as the panels.
- 20 22. A cladding system according to any preceding claim in which the fixing surface is formed in a vertical edge of each panel.
23. A cladding system according to claim 17 in which each panel has a horizontal edge which, in use, can be arranged adjacent a horizontal edge of a further panel.



24. A cladding system according to claim 23 in which the horizontal edges of the two panels include seal means for sealing against adjacent horizontal edges of the or each further horizontal panel.
25. A cladding system according to claim 19 in which the horizontal edge of the  
5 or each further horizontal panel includes seal means for making sealing contact with the seal means of the or both of the said two panels.
26. A cladding system according to any preceding claim in which a said panel is constructed from a first body of material of one density and second body of material of a higher density through which second material load from the fixing means is  
10 transmitted.
27. A cladding system according to any preceding claim in which a said panel is constructed from a first body of material and a second material of higher density forming part of an edge of panel, through which second material load from the fixing means is transmitted.
- 15 28. A cladding system according to claim 27 or 28 in which a recess for receiving part of the fixing means is defined between the first and second materials.
29. A cladding system according to any preceding claim including a cill for positioning at the lower edge of a cladding formed by the system and to which any water draining through the system is guided away from the lower edge.
- 20 30. A cladding system according to claim 29 in which the cill has internal walls which are formed with drainage apertures
31. A cladding system comprising at least two panels formed from plastics material each panel having a fixing surface formed in an edge of the material for co-operation with fixing means whereby the panels can be fixed to a supporting  
25 structure.



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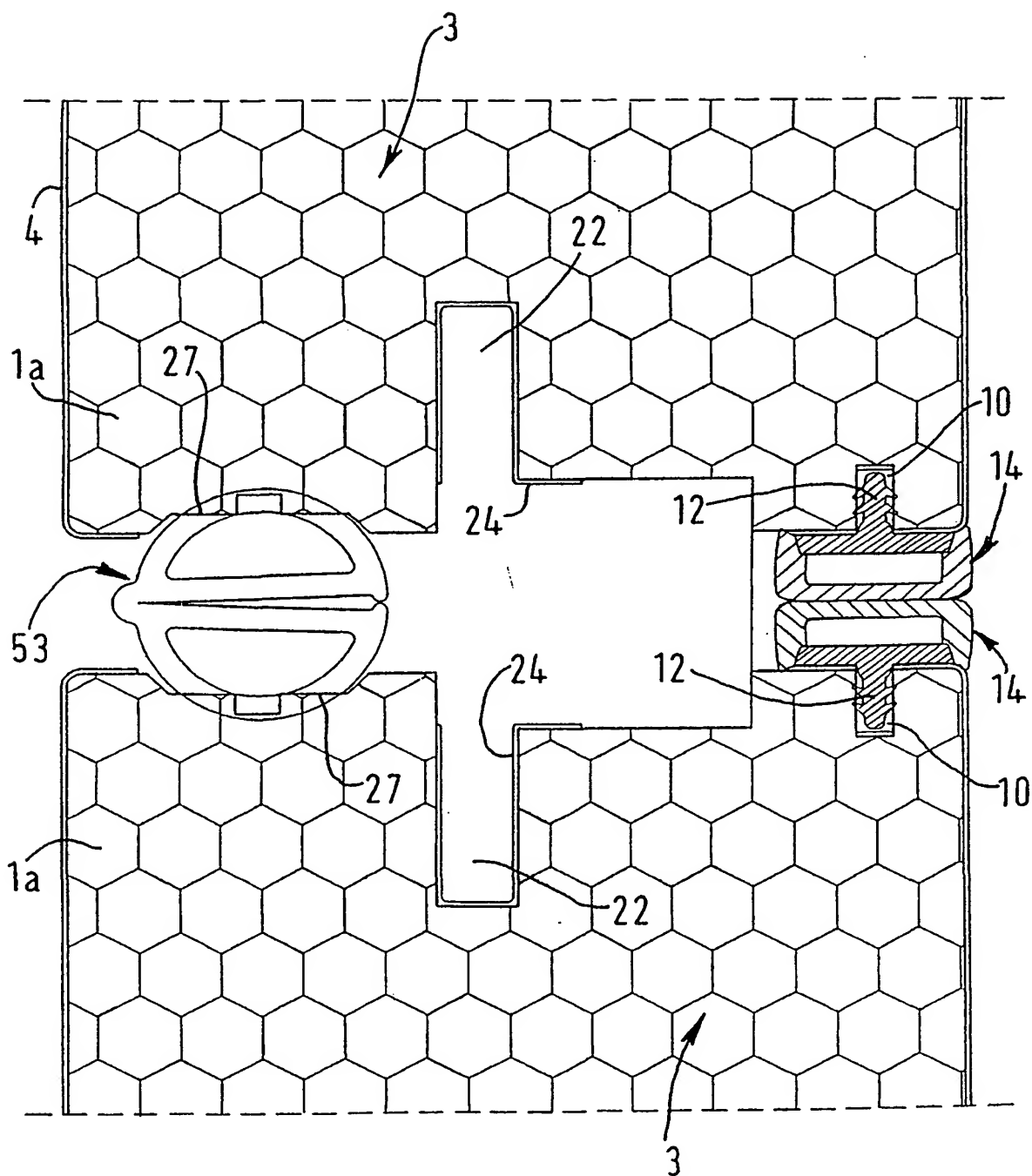


FIG. 2.

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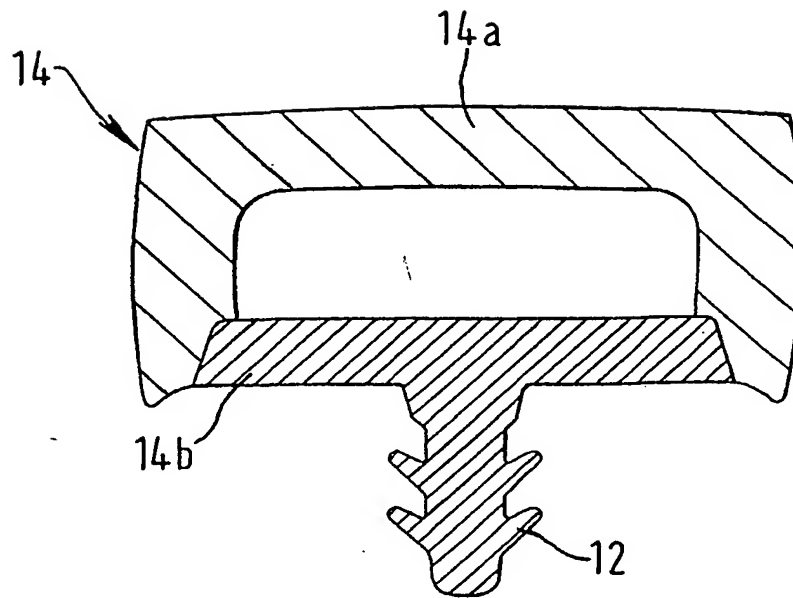
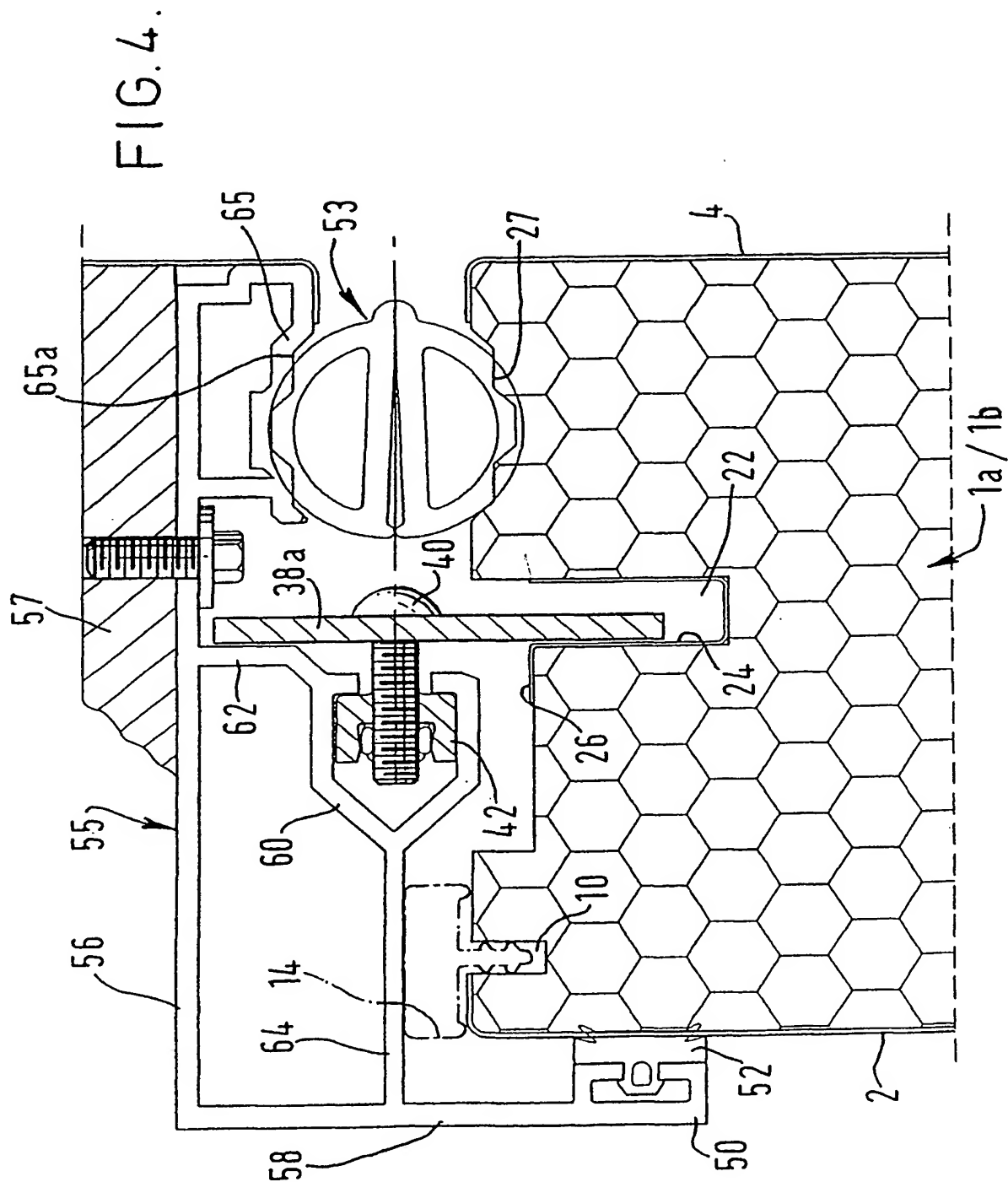
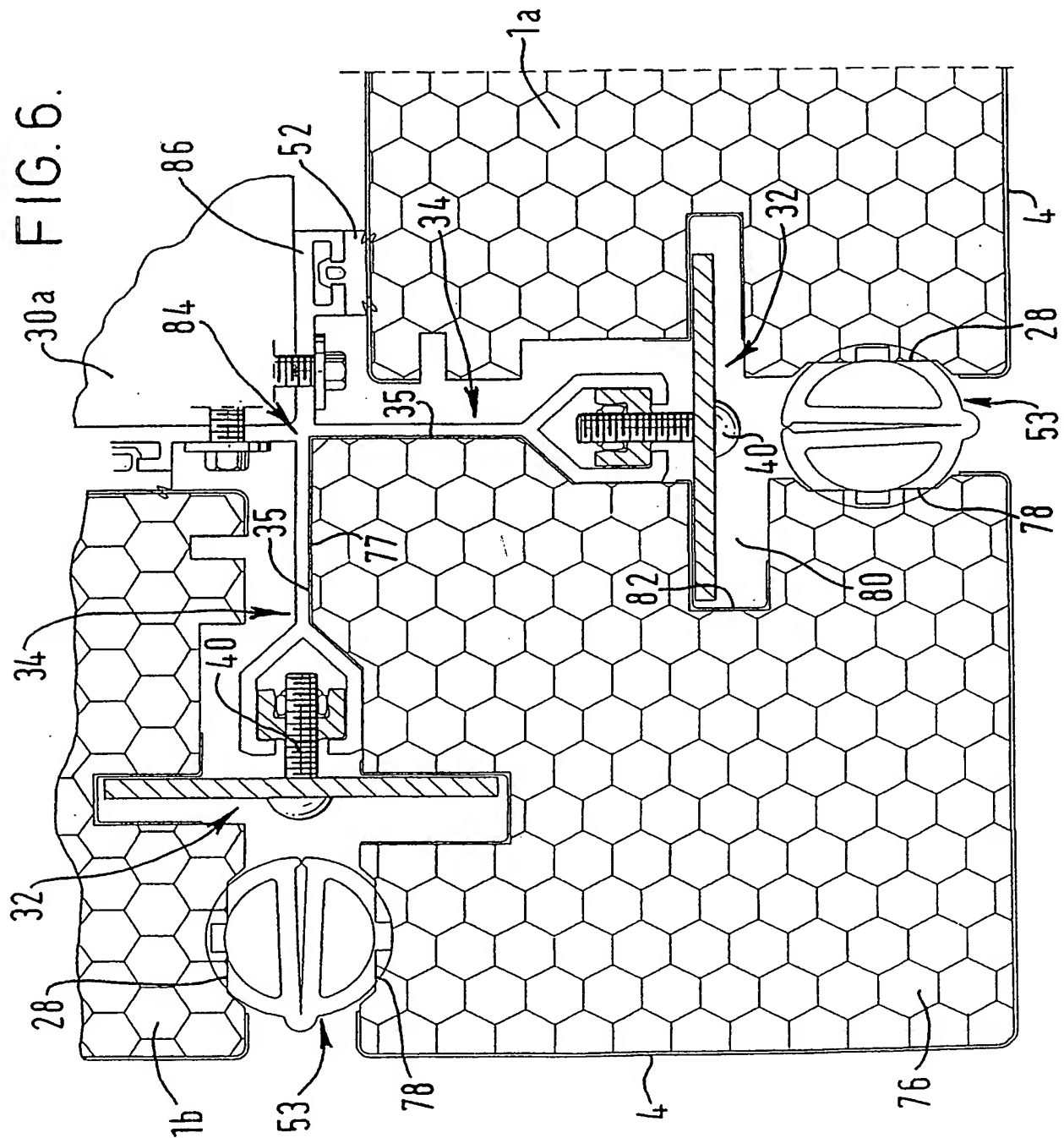
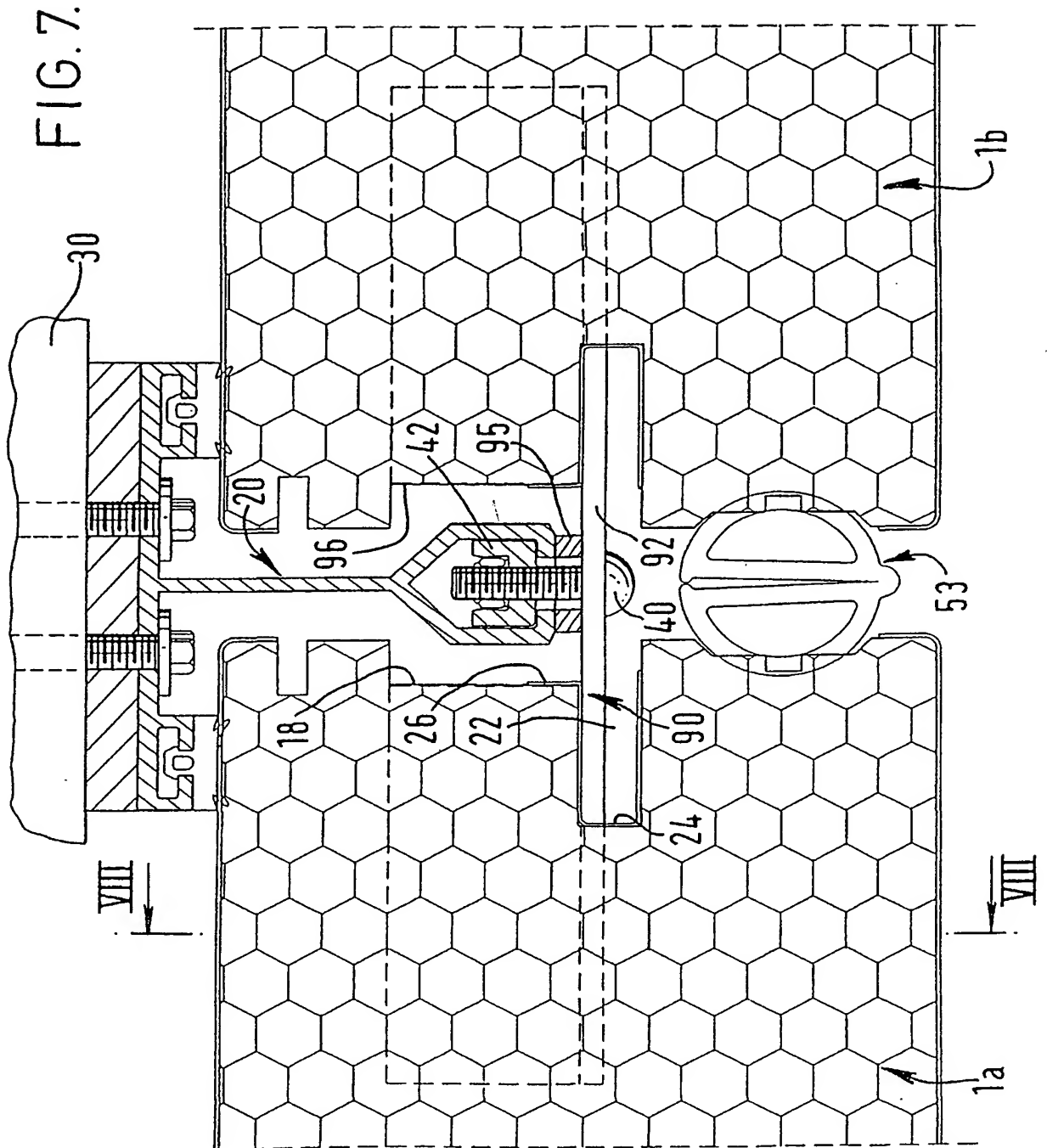


FIG. 3.











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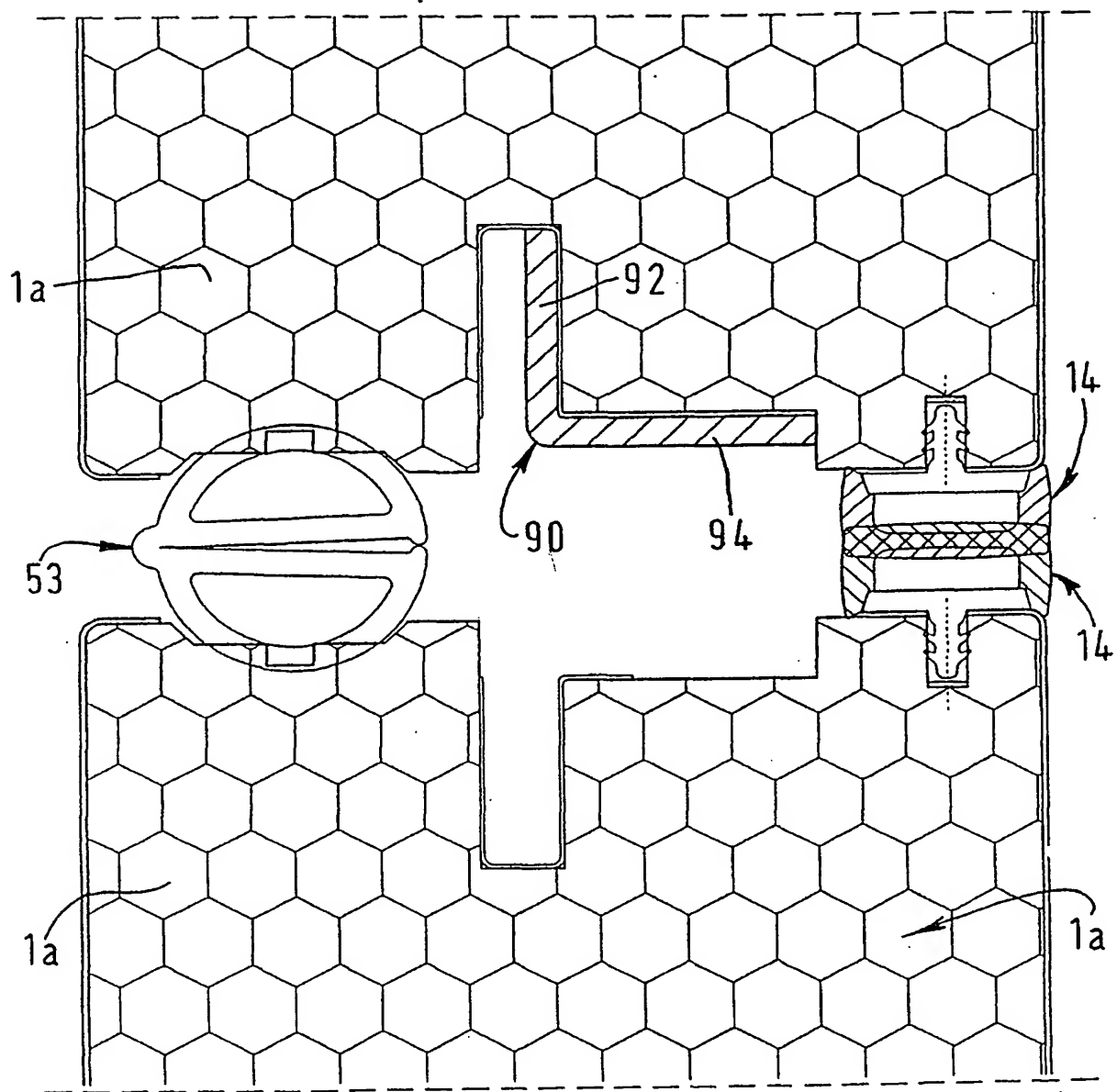
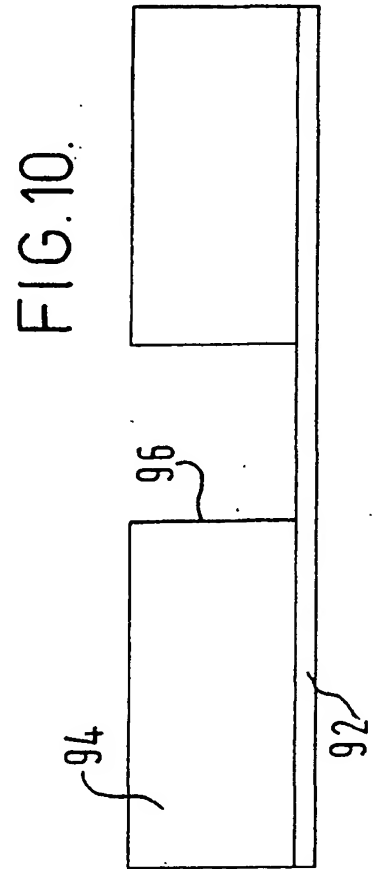
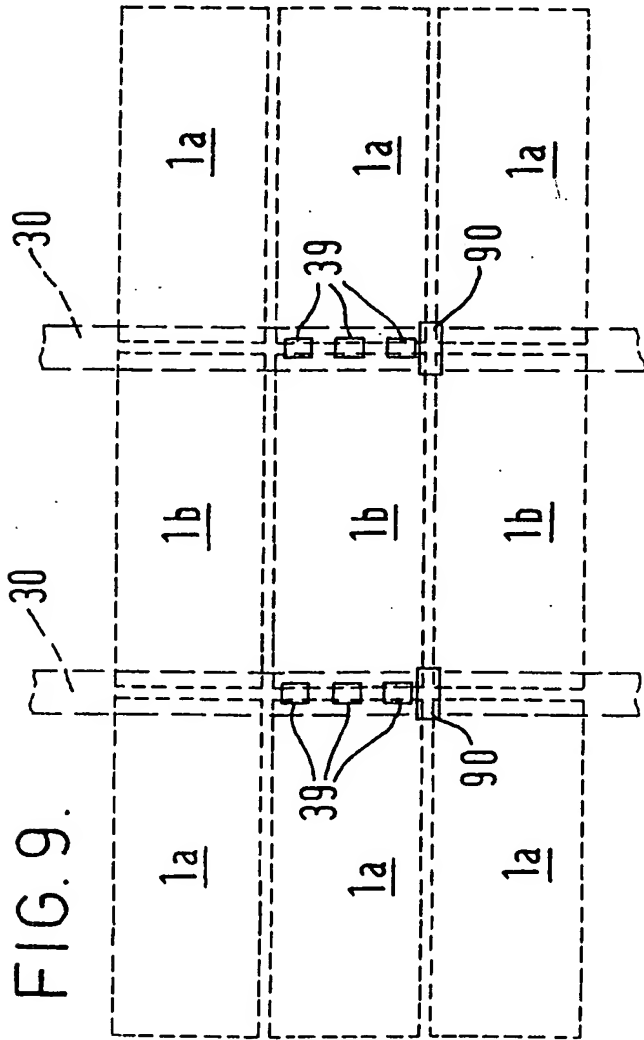
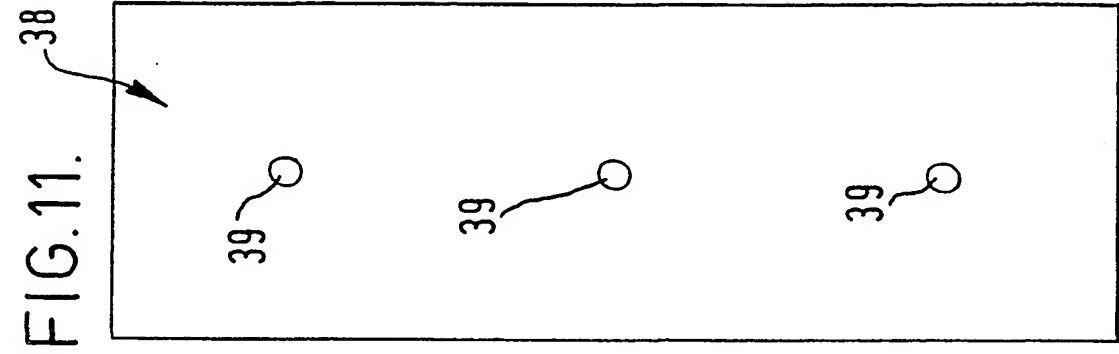


FIG. 8.



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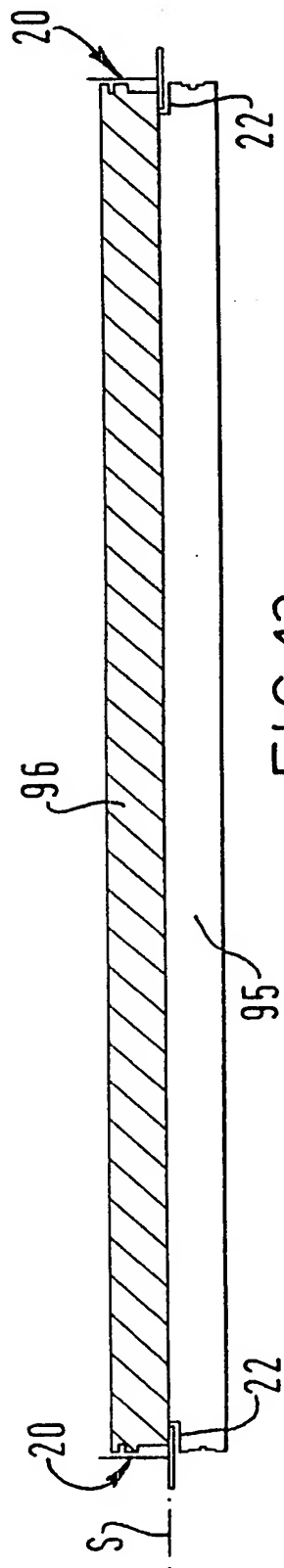


FIG. 12.

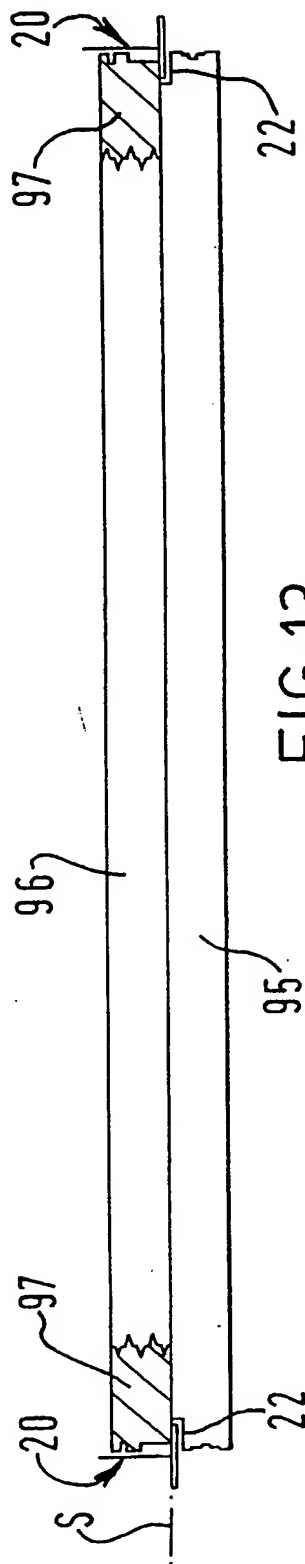


FIG. 13.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 99/03773

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 E04B2/92 E04F13/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 E04B E04F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 0 430 667 A (COSELEY BUILDING SYSTEMS LTD) 5 June 1991 (1991-06-05) the whole document ---	1-16, 22-28 31
X A	EP 0 426 187 A (ALSACIENNE EMAILLERIE) 8 May 1991 (1991-05-08) the whole document ---	1-11, 22, 26 31
X A	CH 677 690 A (MICHEL KOWALSKI) 14 June 1991 (1991-06-14) the whole document ---	1, 4-11, 17-19, 22
A	EP 0 164 952 A (SEALHEAT FLAT ROOFING) 18 December 1985 (1985-12-18) page 5, line 22 - line 29; figure 1 -----	31

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

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Date of the actual completion of the international search

21 February 2000

Date of mailing of the international search report

29/02/2000

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Vrugt, S

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 99/03773

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